Space Weather Technical Forecast

Issued on Thursday, 04 July 2024 at 01:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate, with AR3730 producing an M1.5 flare at 03/0741 UTC. This is a very small and simple region, yet it has been responsible for two M-flares in the last few days. There are now ten sunspot regions on the disc, the majority of which are small and simple. AR3729, in the south near centre disc, is currently the largest and longest spot, with beta-gamma magnetic complexity. To the north, AR3733 has continued to grow though with no recent classification change. AR3730 appears to continue to fade. All other regions are simple and stable at present.

No Earth directed CMEs have been observed in imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 were at background. Wind speeds were slow-ambient ranging from 320-390 km/s. Density was below average. The Interplanetary Magnetic Field, Bt, was weak throughout, below 7nT. The north-south component, Bz, varied weakly between +3/-4nT. Phi angle has been predominantly positive (away from the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was mostly at moderate levels but briefly reached high, with a peak of 1190pfu at 03/1905 UTC. The 24-hour fluence remained below Active on a rising trend, with 3.79e7 integrated pfu observed at 04/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is most likely, with a chance of further isolated M-flares.

Solar Wind / Geomagnetic Activity: There remains a slight chance of a late arrival of a CME from 29 Jun. No further Earth directed CMEs feature in the forecast. Solar winds speeds are expected to be slow-ambient to slightly elevated through much of the period. There is a slight chance of a high speed stream to arrive from coronal hole 49/+, potentially bringing slightly elevated or perhaps elevated wind speeds either late day 3 or early day 4 (6 or 7 Jul).

Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 0-3), with a slight chance of G1/Minor storm (Kp 5) intervals each day from either weak CME or CH HSS arrivals.

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background levels. High energy electron flux has been moderate to high, and is most likely to continue to peak at moderate or perhaps high levels over the coming days, with a gradual decreasing trend. There is a daily slight chance of reaching Active electron fluence.

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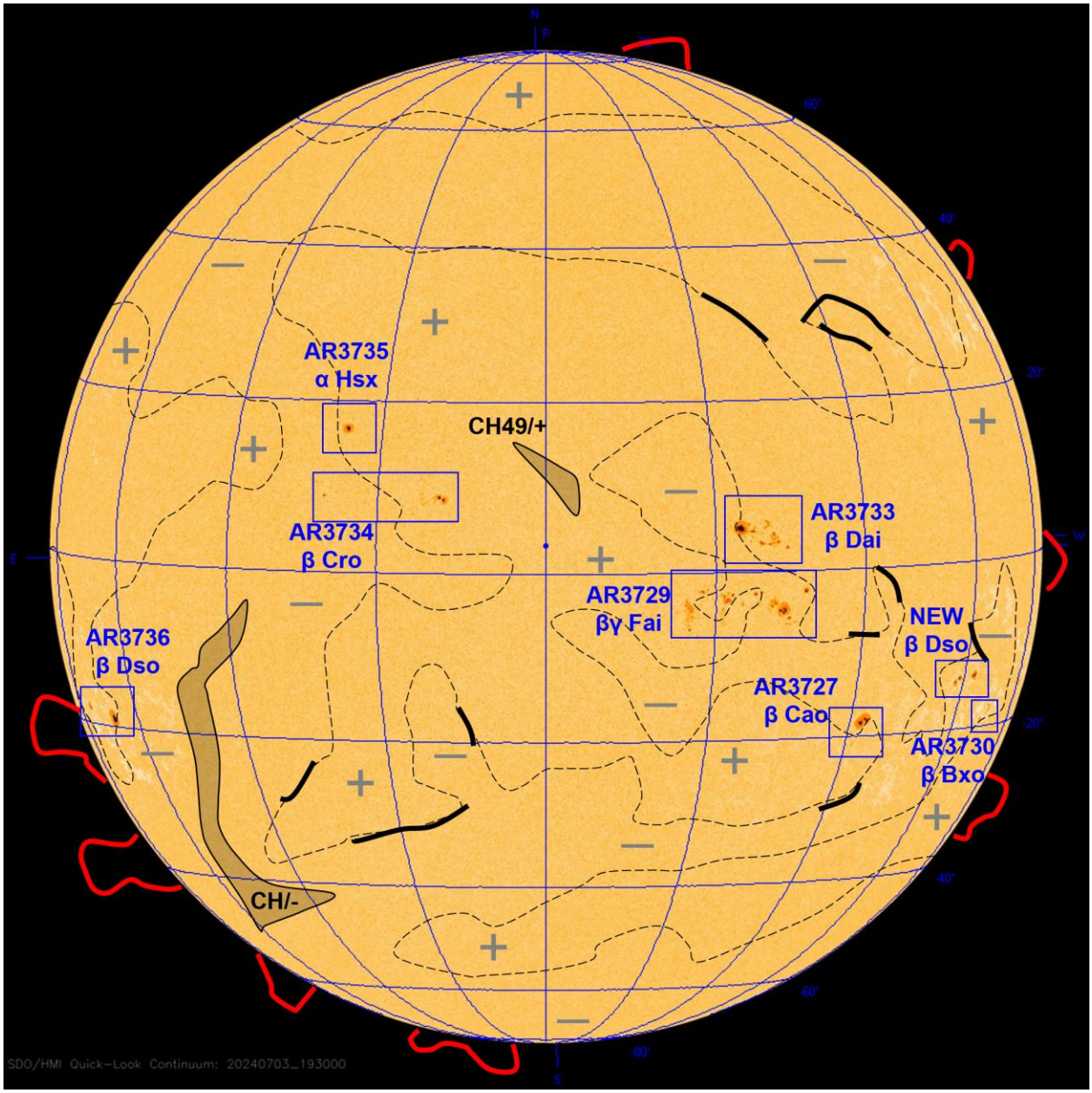
Figure 1. Solar Analysis Valid 03/1930 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

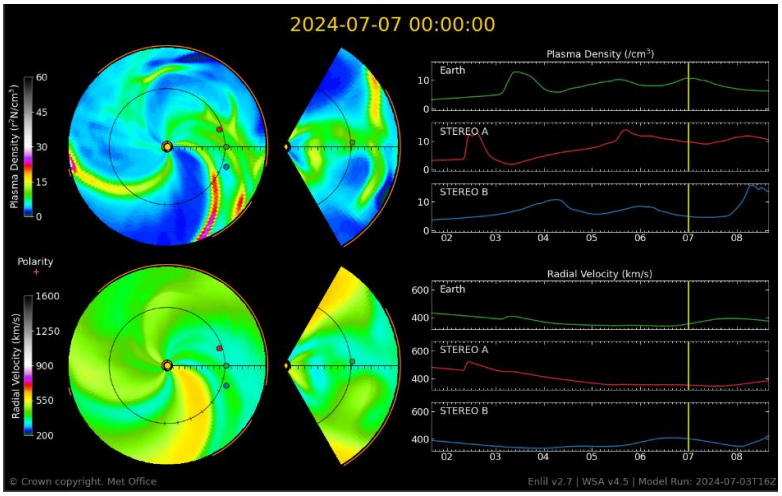
A large filament lift-off and CME was observed 29 Jun in the southwest. Analysis suggested a glancing blow at Earth on 03 Jul, however there is little evidence of this occurring, therefore a continued but reduced risk of a late arrival of the CME is continued into day 1 (04 Jul). Otherwise no other Earth directed CMEs are currently expected.
In the absence of any CME arrival, solar winds speeds are expected to be slow-ambient to slightly elevated through much of the period. There is a slight chance of a high speed stream to arrive from coronal hole 49/+ which has been a fading feature currently near centre disk, this potentially bringing slightly elevated or perhaps elevated wind speeds either late day 3 or early day 4 (6 or 7 Jul).
Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 0-3), with a slight chance of G1/Minor storm (Kp 5) intervals each day from either weak CME or CH HSS arrivals.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	5	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
29/2010	Partial	Filament	SW	780 km/s	03/0000 UTC +/- 12 hrs	Glancing blow possible. Timing uncertain.

Figure 2: MOSWOC ENLIL



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Radio Blackouts - X-Ray Flares:

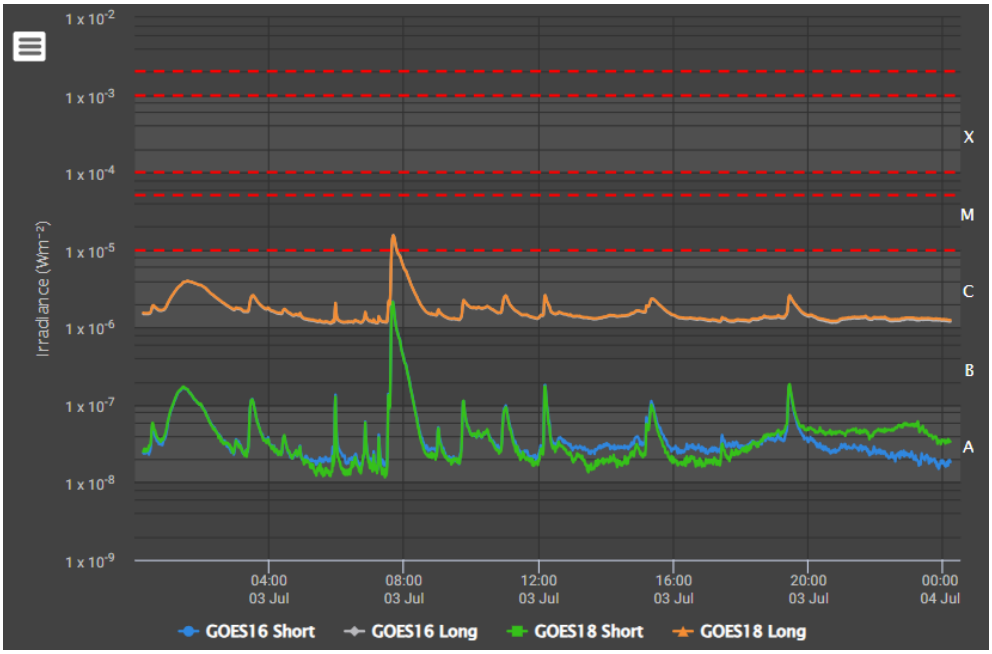
Solar activity has been Moderate, with AR3730 producing a M1.5 flare at 03/0741 UTC. This is a very small and simple region, yet it has been responsible for two M-flares in the last few days.

There are now ten sunspot regions on the disc, the majority of which are small and simple. AR3729, in the south near centre disc, is currently the largest and longest spot, with beta-gamma magnetic complexity. To the north, AR3733 has continued to grow though with no recent classification change. AR3730 appears to continue to fade, though remains responsible for two M-flares in the last few days. All other regions are simple and stable at present.

Each individual region only contributes a small amount to the overall flare risk. Overall, the flare risk has been kept flat throughout with a chance of isolated M-class flares, and a very slight chance of X-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: 24 hour X-ray Trace



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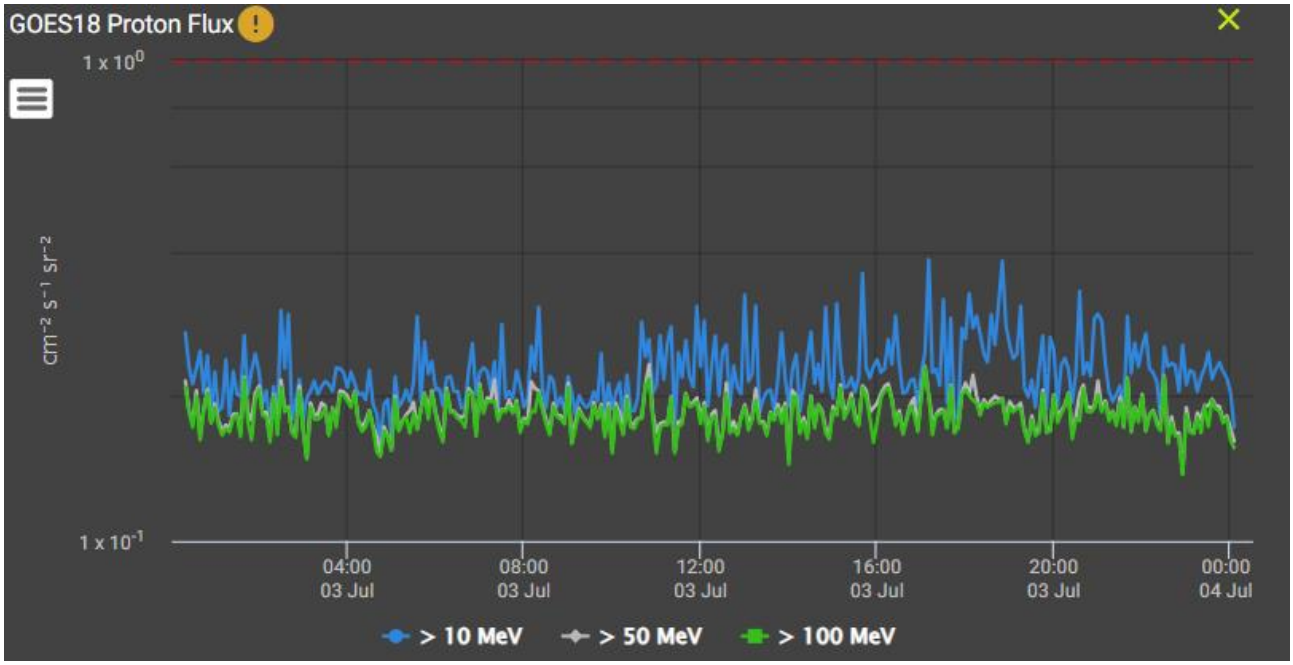
Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as measured by GOES-18, is most likely to remain at background levels. Despite a large amount of sunspots on the Earth-facing disc, they are relatively small and magnetically simple, making proton enhancements unlikely.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: 24 hour proton trace



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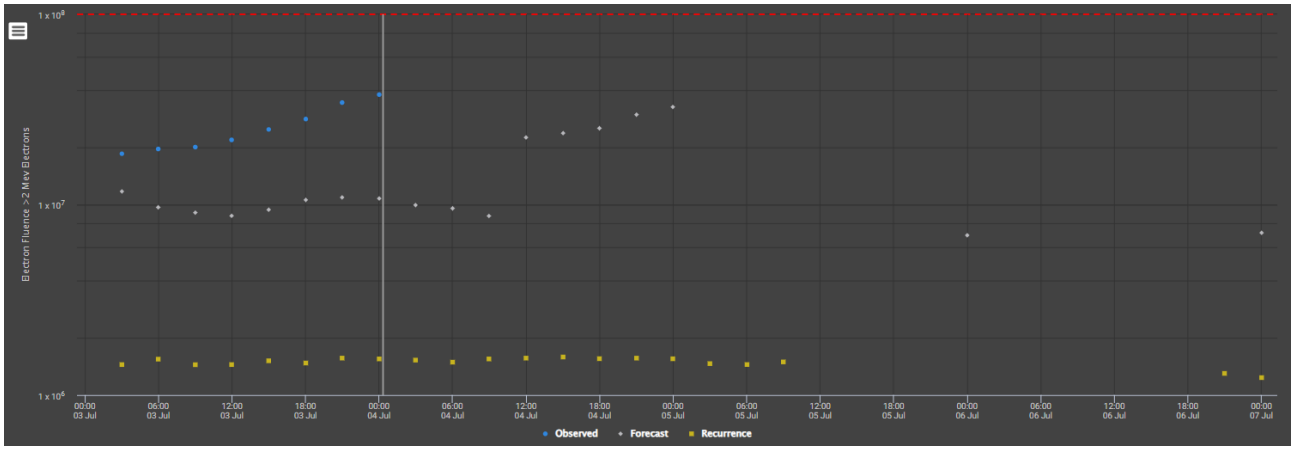
High Energy Electrons Event (≥ 2MeV):

High energy electron flux, as observed by GOES-16, was generally at moderate levels, with a brief spell at high over the last 24 hours, peaking at 1190pfu at 03/1905 UTC. This was due to the relaxation of the Van Allen belts following the CME enhancement on 28 June, combined with a lack of suppression from any CME over the past couple of days. There remains a slight chance of this CME suppressing electron flux on day 1 (Jul 04). Otherwise, electron flux is most likely to continue to peak at moderate or perhaps high levels over the coming days, with a gradual decreasing trend.

Associated electron fluence is most likely to persist below the Active threshold (1e8 integrated pfu), with a daily slight chance of an increase above Active. MOSWOC REFM is forecasting a below Active trend through the next three days, which reflects the most probable outcome.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	10	10	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM fluence forecast/observations/recurrence



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